

ART. XIV.—*Present and Probable Future Distribution of  
Wheat, Sheep and Cattle in Australia.*

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(Communicated by A. E. V. Richardson, M.A., B.Sc.)

(With 3 Text Figures.)

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Australia being essentially an agricultural and pastoral country, it was thought that considerable interest would attach to any method which would graphically and accurately represent the distribution throughout the continent of the units of the main primary industries; further, that such might give some insight into the possibilities of extending the various industries beyond their present boundaries, and the direction in which such extension is likely to take place. With this object in view the accompanying maps were prepared, showing the distribution of the units of the three principal primary industries—viz., sheep, cattle and wheat—in Australia (referring here and in all statistics to the continent of Australia, excluding Tasmania). The method adopted has been to represent a certain number of head of stock, or acres of wheat, by a dot placed on the map as near as possible to their situation, as indicated by official statistics; this gives a more accurate representation of the distribution than can be obtained by differential shading or coloring. Each dot represents respectively 5000 acres of wheat, 10,000 head of sheep, and 1000 head of cattle; these quotas are small enough to show a relatively sparse distribution, yet without showing too great an area where the dots run together, and no differentiation can be shown in the areas of concentration of the respective units. The statistics used were those for the year 1918-19, being the latest typical season for which details of all the States were available at the time the work was commenced. Similar maps have been prepared by the United States Department of Agriculture, but it is hoped that so far as Australia is concerned those now published are not only based on later records, but more accurately represent the actual distribution of the units throughout the country.

Embodied in the maps is also meteorological data relating to rainfall and temperature, which is necessary for adequate consideration of the factors affecting the present distribution and probable extension of the industries. The data given consist of various isotherms (i.e., lines of equal average mean annual temperature) with the 5, 10, 20, 30, 40 and 60 inch isohyets (i.e., lines of average annual rainfall), in the case of the two stock maps; and for the wheat map, the 5, 7.5, 10, 15 and 20 inch lines of winter rainfall, or more strictly the rainfall during the growing period of the crop, i.e., April to October, inclusive.

Acknowledgment is here made to the Government Statists of the various States and the Department of Home and Territories for the furnishing of the statistics necessary to the work, and to the Commonwealth Meteorological Bureau for meteorological data used.

### **Wheat.**

The total area sown to wheat for grain and hay in Australia, for the season 1918-19, was 9,647,433 acres, and of this total New South Wales contributed 3,227,374, South Australia 2,571,208, Victoria 2,488,810, Western Australia 1,336,502, and Queensland 23,539 acres. This area represented approximately 3.5 per cent. of the total area that year sown to wheat throughout the world. Until the last four seasons, which have shown a decline due to abnormal labour and marketing conditions, there had been a steady expansion of wheat-growing in Australia, her production increasing from 1.6 per cent. of that of the world in 1906-07, to 4.8 per cent. in 1916-17, and it is hoped to show that there is ample room for this extension to continue.

Considering the distribution of the area shown by the map (Plate I.), the most striking feature is the very limited extent of the wheat-growing country. There is, indeed, a distinct wheat belt forming a crescent-shaped area some distance inland from, and approximately parallel to, the south-eastern coast line, approaching and broken by the coast line as the latter turns northwards along South Australia, and continued again as a similar belt back from the south-western coast of Western Australia.

The factors limiting the distribution of the wheat acreage may be classed under two heads—natural and political or economic. The chief natural factors are the soil and climatic conditions of rainfall and temperature. The soil within any climatic region



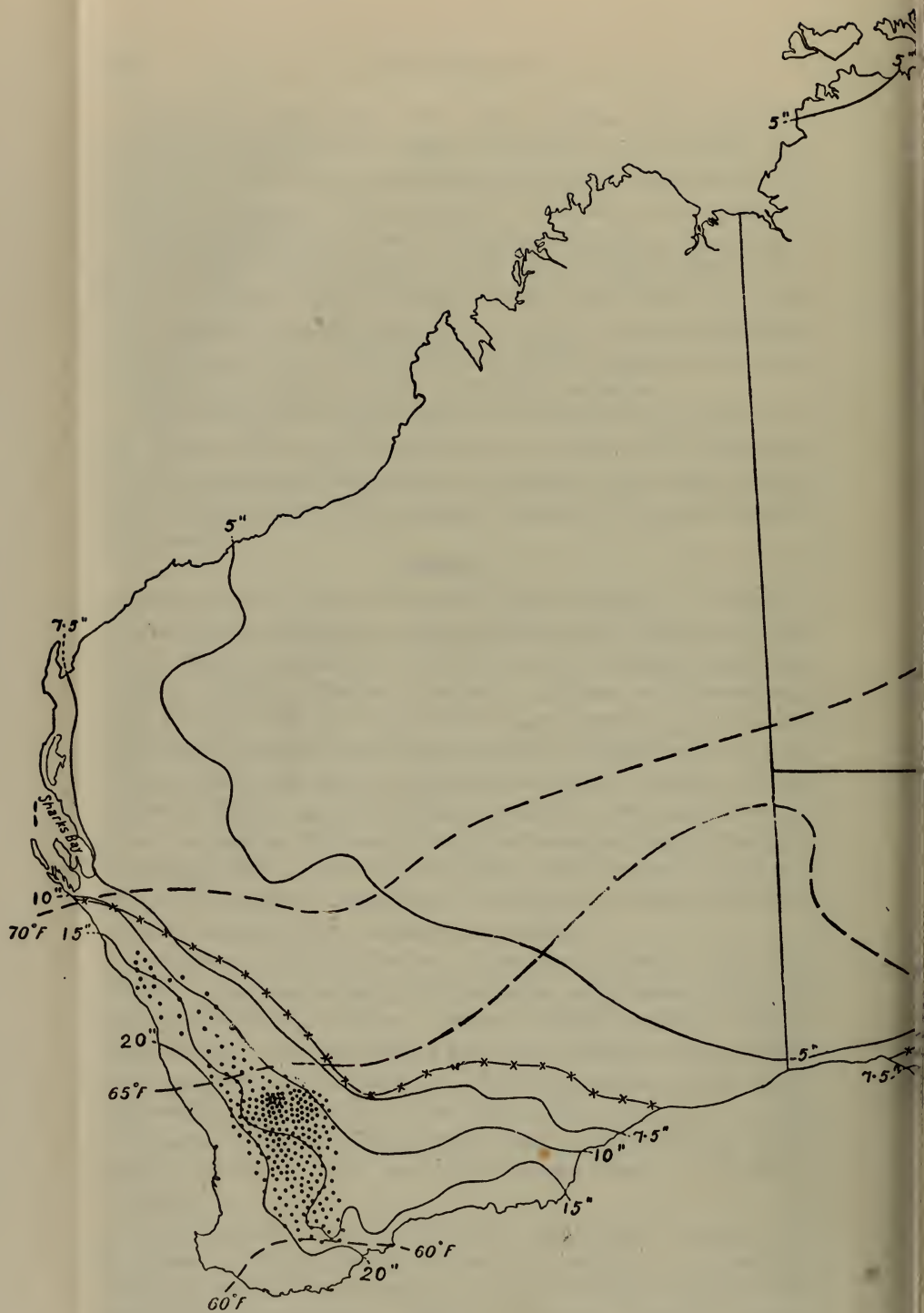


FIG 1.—DISTRIBUTION OF WHEAT ACREAGE IN AUSTRALIA

Each dot represents ~5,000 acres.

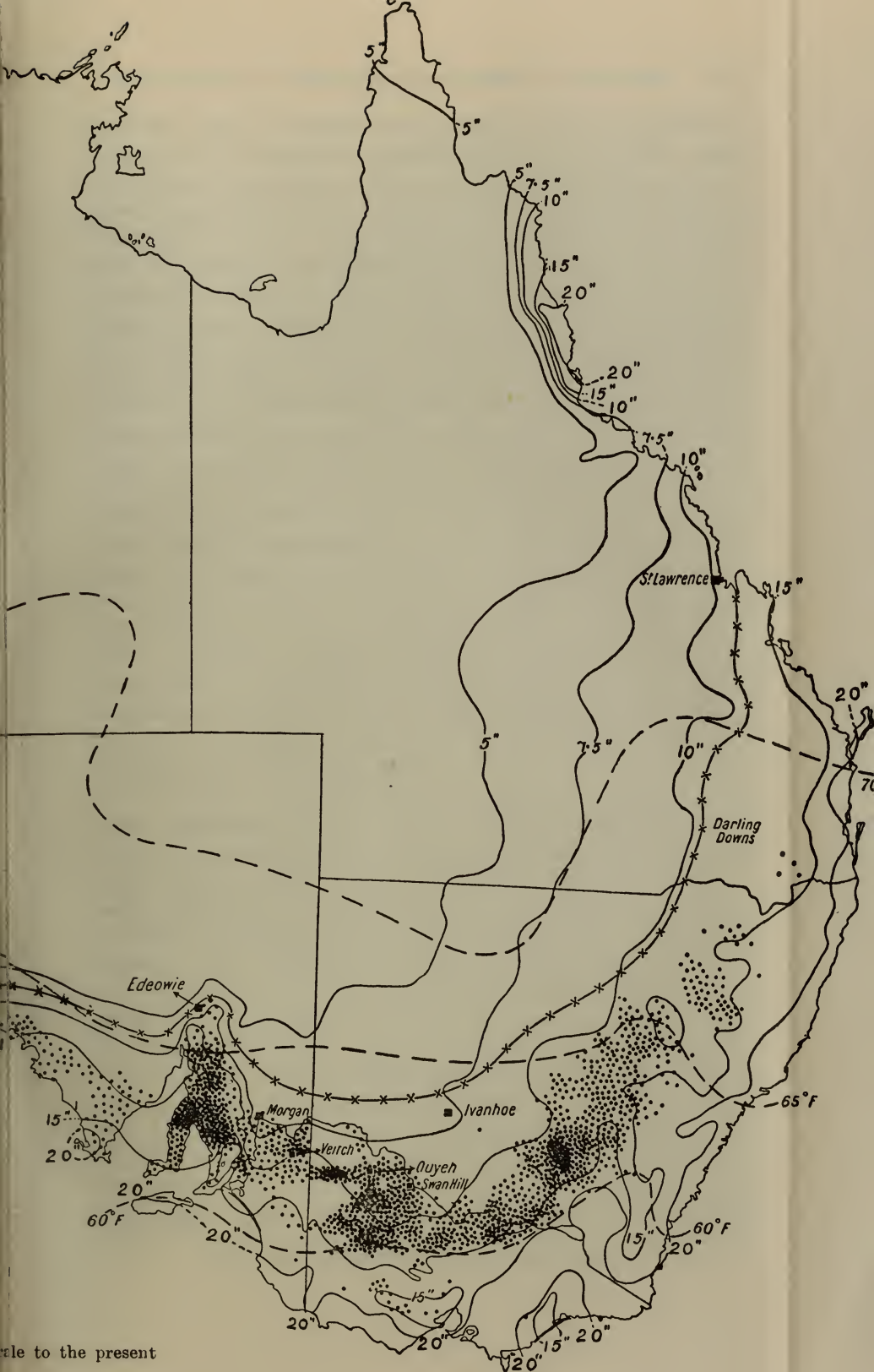
Lines of average "winter rainfall" shown thus —————

Lines of average mean annual temperature shown thus - - - - -

Lines showing probable inland limit of wheat belt as indicated by climatic conditions of

furthest inland areas under crop, shown thus x-x-x





ale to the present



will vary widely in fertility, but it is safe to say that, within the regions to be indicated as suitable, and not yet used for wheat production, though there are areas of low soil fertility, there are many thousands of acres of which the soil is eminently suited to the growth of wheat. As regards the other two factors, rainfall and temperature, the rainfall both in its total amount and incidence in respect to the growing period of wheat, is far the more important. Temperature, in fact, can be almost disregarded as a limiting factor; there is no extensive area of cultivable land in Australia which is actually too cold for the growth of wheat, though in our colder districts other conditions combine to make it less profitable to grow wheat than other crops. Similarly, though wheat is not grown north of the 70 deg. isotherm, there is a considerable area north of this line climatically similar to the wheat-growing areas of India.<sup>1</sup> Here, again, it is the question of the degree of profitableness as compared with other agricultural and pastoral pursuits under our present conditions of development, rather than temperature, which limits the extension of the wheat area in a northerly direction. At the same time there is evidently an optimum condition of temperature for wheat in Australia, for practically the whole of the area sown to wheat is situated between the 60 and 65 deg. F. isotherms, there being a marked coincidence between the 60 deg. isotherm and the southern limit of the wheat belt.

Considering the distribution of acreage in relation to the more important factor of rainfall, the rain of importance to wheat is that falling during the growing period of the crop, i.e., April-October, inclusive, the rain falling during the summer being largely lost by evaporation, and also sometimes tending to reduce the wheat yield by causing lodging of the crop and the spread of rust. Therefore the lines of rainfall shown are those for this period. It is seen that practically all our wheat is now grown between the lines of 7.5 and 15 inches of winter rainfall. In Western Australia there is certainly a considerable area between the 15 and 20 inch lines, but here settlement is so sparse that more intensive agriculture has not yet pushed the wheat belt back into its true sphere in the dry farming regions. In South Australia, Victoria and New South Wales, the 15-inch line corresponds very closely with the southern boundary of the wheat belt, this line approximately separating the dry farming

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<sup>1</sup>Vide Griffith Taylor, "The Australian Environment."

area from the closer settlement country where more intensive farming is possible. The 10-inch line of winter rainfall has usually been regarded as the safe limit for wheat growing, but in South Australia and Victoria wheat is grown over a very considerable area inside this line, extending to, and even passing the 7.5-inch line. The wheat-growing districts about Edeowie and Morgan in South Australia, and immediately south of Mildura in Victoria, are beyond the 7.5-inch line of winter rainfall; while between the 10 and 7.5-inch lines are the older settled Mallee districts of Veitch, Ouyen and Swan Hill, where wheat growing has been an established and successful industry for over 10 years. It can be fairly assumed then that country having a winter rainfall of somewhat under 7.5 inches, of reliability equal to that in the areas indicated, and an average temperature not greatly above that of these areas, is capable of growing wheat under our present methods of cultivation and economic conditions of price of wheat, land and labour. In New South Wales the 10-inch line has not yet been passed, and it would seem that in the northern portion of the State it does indicate the probable limit of the wheat belt. The greater variability of the rainfall, and the higher temperature, causing increased loss by evaporation, make a given average rainfall less efficient in crop production here than a similar amount in the cooler and more reliable rainfall areas in the southern portion of the State.

It is difficult, indeed, to indicate the ultimate inland limits of the wheat belt in Australia, for with improved, drought-resistant varieties, and better methods of cultivation, new areas are being brought under crop which but a few years previously it was thought impossible to successfully cultivate. This increasing efficiency will, it is hoped, continue. But even with our present knowledge there is ample room for expansion before what may be termed the probable limits of the wheat belt in the more immediate future are reached. The line shown thus: —x—x—, is an arbitrary line, indicating what appears, from climatic considerations, to be such probable limit, and it is seen to enclose immense tracts beyond the present limits of development. Commencing on the 10-inch winter rainfall line, south of Shark's Bay, W.A., where the variability of the rainfall, is too great to warrant an extension of the 7.5-inch line, it passes west beyond the 7.5 line, as the more reliable rainfall along the



southern coast is reached. In this State alone we see a vast area of country awaiting exploitation, the greater portion of it having a winter rainfall equal in reliability and total amount to the well-developed wheat belt in Victoria. Along the west coast of South Australia this reliability of rainfall still holds, and here again might be expected a development beyond the 7.5-inch line, as has already occurred in the regions of less reliable rainfall about Edeowie. Passing over the extension of the belt north of Spencer's Gulf, the line turns southwards and runs somewhat north of the Murray, and approximately parallel to the 7.5-inch line to about Ivanhoe, N.S.W., enclosing the immense tract of fertile Riverina country. Thence the line passes north-east beyond the 10-inch line, and north to St. Lawrence on the Queensland coast. As previously stated, the greater variability and higher temperature make the actual rainfall less effective than in the southern areas; hence this marked departure from the 7.5-inch line. As to the probable northerly limits of the belt, although there is a considerable area shown with a sufficient winter rainfall, and where wheat can doubtless be grown, yet it seems unlikely that any considerable amount will be grown north of the Darling Downs, the high temperature, ample rainfall, and its summer incidence combining to make wheat less profitable than other crops.

The present wheat belt, as shown, extends over an area of some 124 million acres, of which only one acre in fifteen, or a total of nearly eight million acres was under wheat in 1918-19. Since none of this is mountainous country, and wheat is everywhere the principal crop, it might be expected that the area at present sown will be about trebled before this belt is utilised to anything like its full capacity. But, apart from this area, there is in the probable wheat belt indicated further inland an area of some 138 million acres. Assuming that this area can be developed only to the same extent as at present obtains in the Victorian Mallee, which is indeed a reasonable assumption when it is remembered that 20 years ago the advisability of abandoning the Mallee for settlement was seriously considered, and that even now but a relatively small portion of it is developed to any extent, this area would then carry a population of some 570,000, or  $2\frac{1}{2}$  people per square mile.

Aggregating the two areas, we have a wheat belt of over 260 million acres. Of this we might ultimately expect at least 40

million acres under crop each year ; this, with an average yield of 10 bushels per acre, would give at least 400 million bushels annually, which, at the present Australian rate of consumption per head of population, and deducting the necessary quantity required for seed, would supply flour sufficient for the requirements of over 50 millions of people. It is not to be thought that even this is considered the limit of our possibilities as a wheat-producing country. It is a conservative estimate of the possible production from this area only, based on a low proportion of land under crop and a low average yield per acre. In the closer settlement country, wheat can be grown in rotation with other crops under conditions of intensive agriculture; the acreage sown in these areas would not approach that of the wheat belt, but with a higher average yield per acre the production would be appreciable.

It is clearly evident that the factors determining the present actual limits of the wheat belt are economic and not natural ones. The limits on the coastal side of the belt are determined by questions of profit in competition with other crop and live stock industries; inland, practically in all cases by transport facilities. The most striking instance of this is in the undeveloped areas of Mallee land on either side of the Ouyen-Murrayville railway line. Again, the decided boundary in South Australia and New South Wales where the wheat belt stops at the Murray River, coincident with the limits of railway facilities. We have a long way to go in extending this, the chief present economic limit to the development of the wheat industry, before we approach the natural boundaries indicated above.

### **Sheep.**

In the year under consideration, the sheep population of Australia numbered some 85,194,503, and of these New South Wales claims 37,381,874, Queensland 18,220,985, Victoria 15,773,902, Western Australia 7,183,747, South Australia 6,625,184, and Northern Territory 8,811 head. This number represents approximately 16 per cent. of the world's sheep, emphasising Australia's position as a leading sheep and wool-producing country.

Examining the distribution of the sheep throughout the continent (Plate II.), it is seen that the belt of maximum concentration is in South-eastern Australia, and that it coincides roughly with the wheat belt, the main departure being in the

